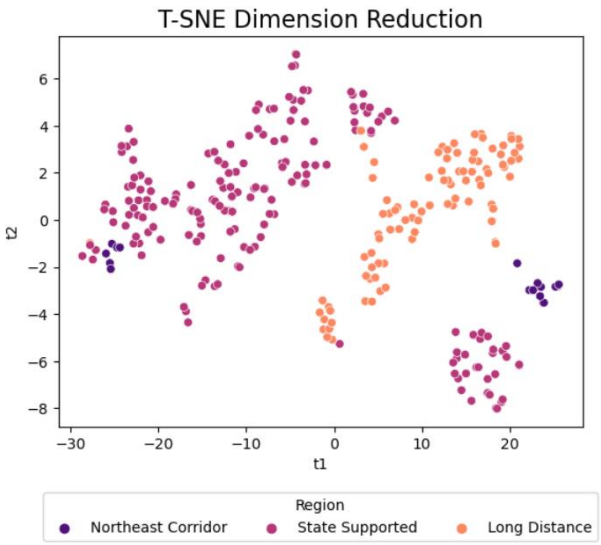
Amtrack Executive Summary

Julia Haas

What routes are "similar" to each other? What makes them "similar" to one another?

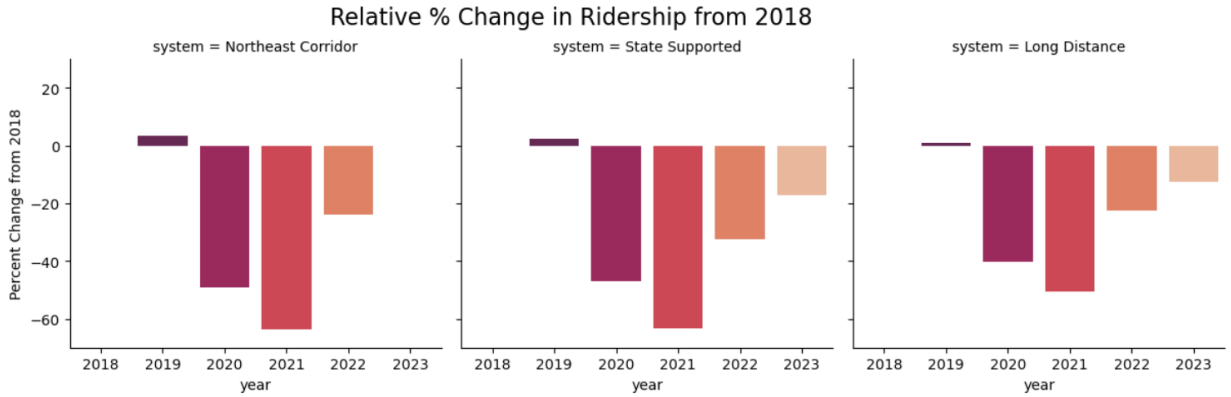
I utilized a dimension reduction technique called t- distributed stochastic neighbor embedding to look for similarities. This technique is known for highlighting relationships between data points in a lower dimension that is easier for visualization. I utilized this dimension reduction with route data relating to adjusted allocated operating sources, adjusted allocated operating uses, passenger miles, revenue-to-cost ratios, and ridership for years 2018 through 2023. As a result, we can see distinct groupings that indicate similarities in routes. When coloring these points by system type, each system clustered with points in the same system for the most part. The distance between clustering does not mean very much for interpretation. Still, it is interesting to see that a small group of Northeast Corridor routes are being grouped with State Supported routes based on the abovementioned variables. We can also see one State Supported route being grouped with Long Distance routes. This route is reading in with characteristics similar to Long Distance routes because it is more like a long-distance route than a state-supported route. Regarding other features like on-time performance, routes of similar system types also behave similarly. Northeast Corridor routes have the highest on-time performance, followed by State Supported routes and Long-Distance routes.



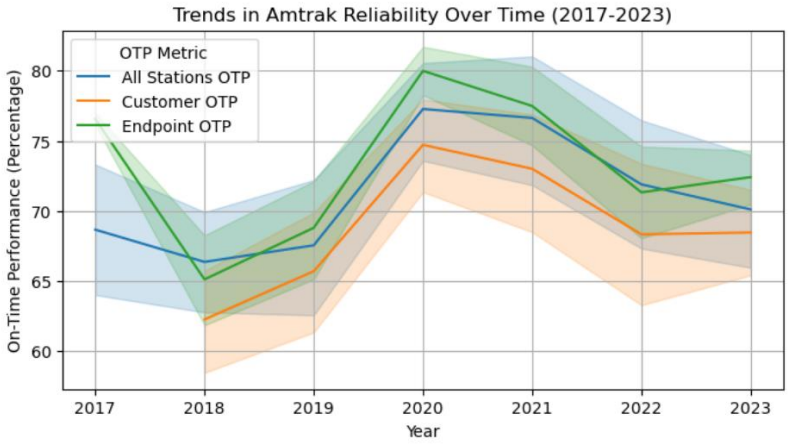
How were routes impacted by COVID? Did some suffer more than others? Did some routes recover better than others?

The figure below represents the average percentage of change in ridership from 2018 for each system. When we investigate changes in ridership, we can see that a significant dip in ridership occurred in 2020 and 2021 compared to 2018 for Northeast Corridor routes, State Supported routes, and Long-Distance routes. This is most likely due to the Covid-19 pandemic and people's choice not to travel and/or quarantine. Northeast Corridor routes

had at most about a 65% decrease along with State Supported routes. Long Distance routes seem to have been impacted less, but still a considerable amount at around a 50% decrease. An increase in ridership in 2019 could explain that before the pandemic, ridership was increasing. Post-pandemic Northeast Corridor routes have recovered to similar ridership rates as 2018. State Supported and Long Distance routes seem to be in the process of recovery, with a lower ridership in 2023 than in 2018.



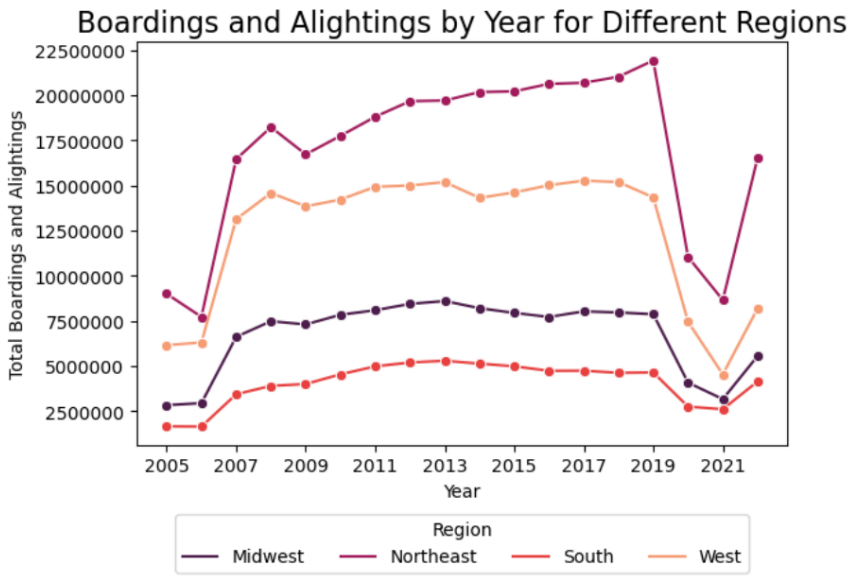
Is Amtrak becoming more or less reliable as a method of transportation?



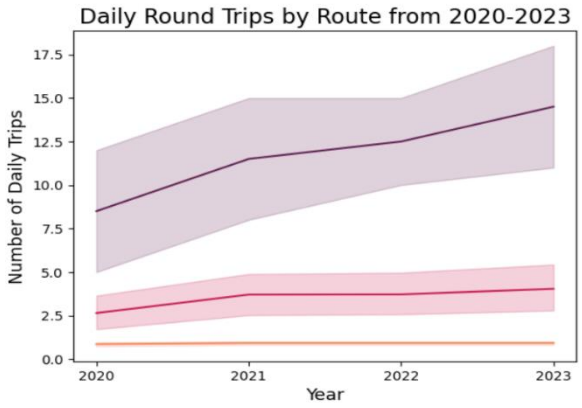
A key feature to look at when investigating reliability is on-time performance. Generally, on-time performance was best during 2020, the peak year of Covid-19. This is most likely because of the decline in overall routes being taken due to quarantine and possible precautions set in place to keep the trains sanitary, which required high on-time performance. The lowest year for on-time performance was 2018. Despite COVID-19, routes have gotten more consistent overall from 2018 to 2023, and most on-time performance metrics seem to be heading upwards.

How has ridership changed across different states in different years? How is Amtrak meeting (or failing to meet) this demand with regular daily trips?

For the purpose of visualization, each state was designated into one of four different regions: Midwest, Northeast, South, or West. In every region, we see an increase in total boardings and alightings beginning in 2006. The region with the highest total boardings and alightings is the Northeast. The state with the most influence in this region is likely New York. After 2008, boardings and alightings seem to taper off in almost all regions, and in the South, Midwest, and West, there appears to be no significant increase or decrease until about 2019. The Northeast has a gradual increase from 2009 to 2019. There is a sharp spike in the decline in boardings and alightings from 2019 to 2020 for all regions and another dip for the Northeast, West, and Midwest from 2020 to 2021. The drop in boardings from 2019 to 2021 is most likely due to the Covid-19 pandemic. From 2021 onward, each region has experienced an increase in boardings and alightings, especially in the Northeast.



We can see from the plot and small table below that overall daily round trips for Long Distance, Northeast Corridor, and State Supported routes all increased from September 30th, 2020, to September 30th, 2023. As stated previously, boardings and alightings increased in all regions from 2021 to 2023, but here, we can see that the increase in daily round trips is especially significant for the period between September 2020 and September 2021, when boardings were decreasing or stagnant. Long-distance routes faced the smallest increase overall, and Northeast Corridor and State Supported routes had increases for each year measured. This increase suggests that Amtrack is meeting the demand for trips.



year	2020 - 2021	2021 - 2022	2022 - 2023
system			
Long Distance	7.778%	0.0%	0.0%
Northeast Corridor	35.294%	8.696%	16.0%
State Supported	35.135%	4.0%	8.654%